

⁽¹²⁾ UK Patent Application ⁽¹⁹⁾ GB ⁽¹¹⁾ 2 299 599 ⁽¹³⁾ A

(43) Date of A Publication 09.10.1996

(22) Date of Filing 01.04.1996

(30)	Priority Data		
(31)	9506797	(32)	01.04.1995
	9524690		02.12.1995
		(33)	GB

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(52) UK CL (Edition O)
E1F FLC

(56) Documents Cited

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(58) Field of Search
UK CL (Edition O) E1F FLC
INT CL⁶ E21B 37/00 37/02
Online: WPI

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(54) Well cleaning apparatus

(57) Apparatus for cleaning the interior of well tubing comprises a body member 10 to which is attached at least one cleaning pad 14, comprising a body (32 figure 3) whose outer face is provided with bristles 38. A plurality of cleaning pads may be provided in an upper row at 120° intervals around the body member, circumferentially offset to which is a lower row of cleaning pads also at 120° intervals. The bristles may be nylon or hardened metal wire and the body may be a drillable material such as resin fibre or malleable metal. The apparatus may include at least one protection pad (50 figure 5) of a softer material than the well tubing mounted on the body member 10, a plurality of such pads may be circumferentially spaced around the body member. A row of protection pads may be provided above the upper row of cleaning pads and another row of protection pads may be provided below the lower row of cleaning pads.

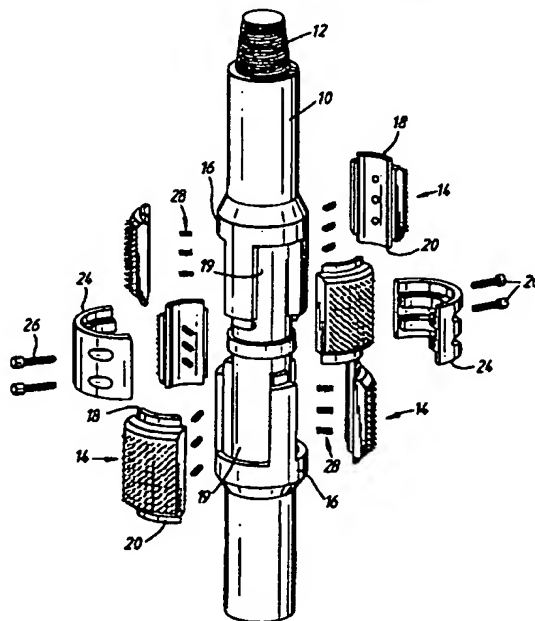


Fig.1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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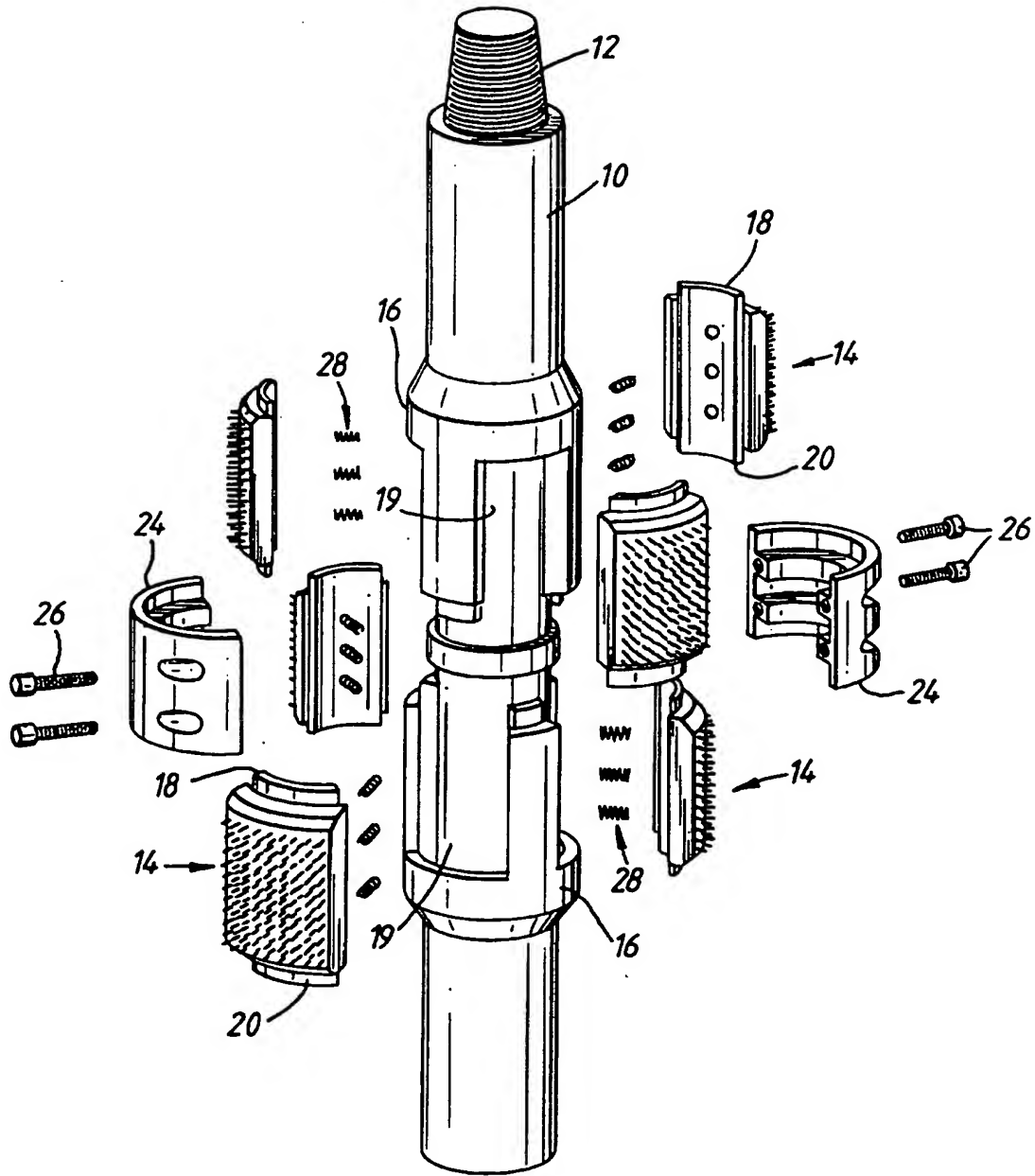


Fig.1

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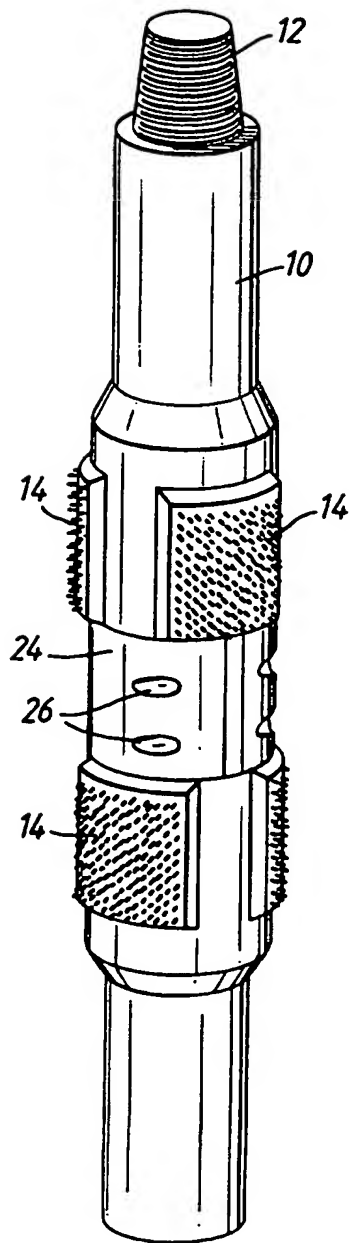


Fig. 2

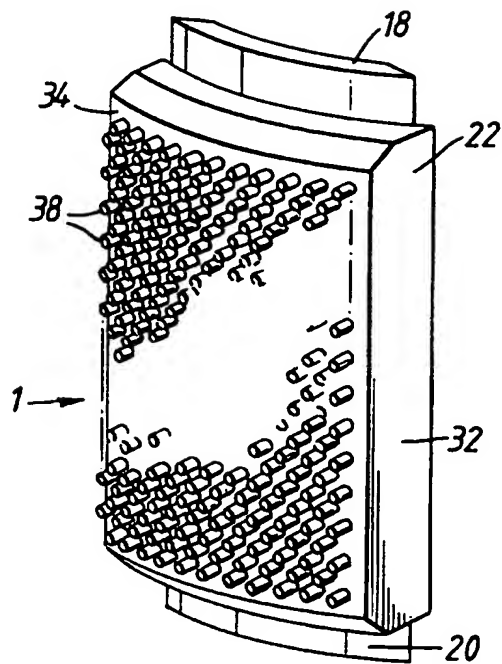


Fig. 3

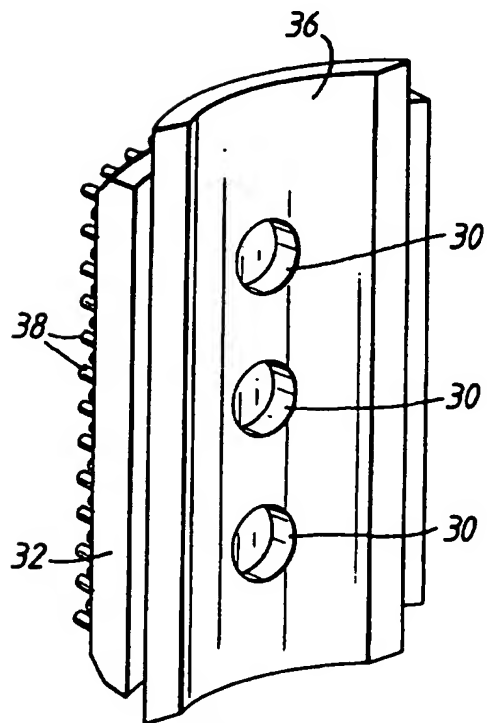


Fig. 4

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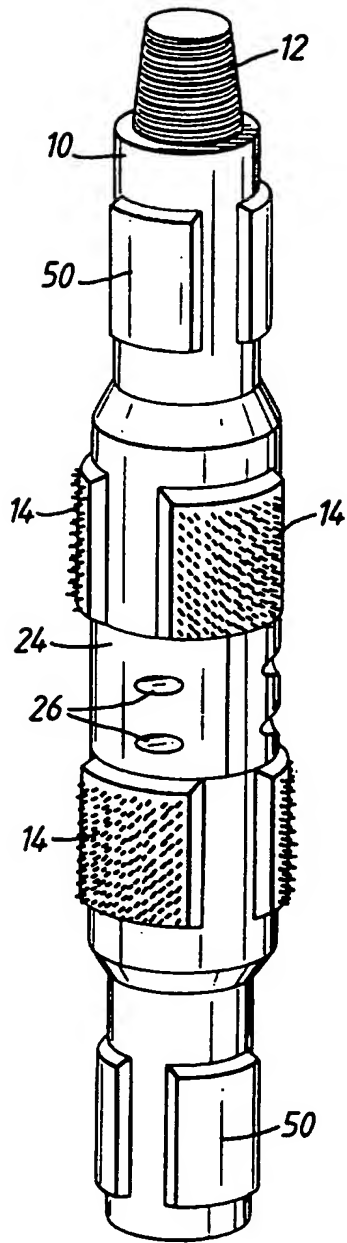


Fig. 5

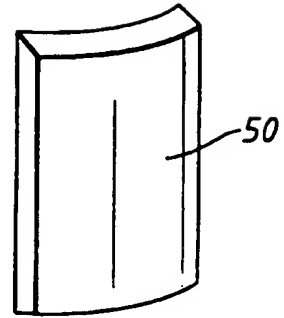


Fig. 6

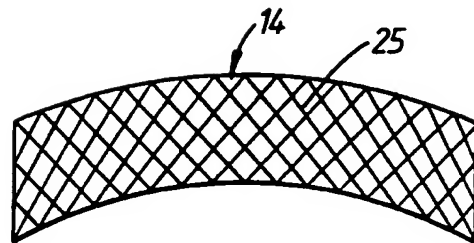
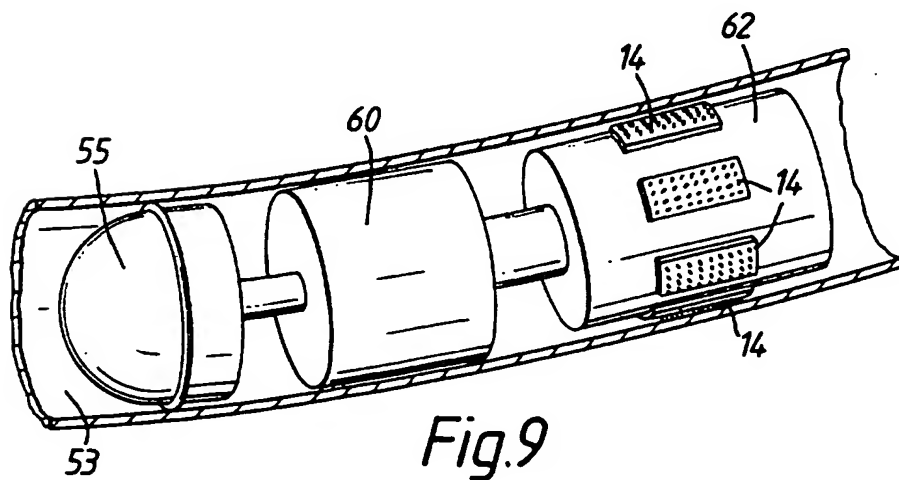
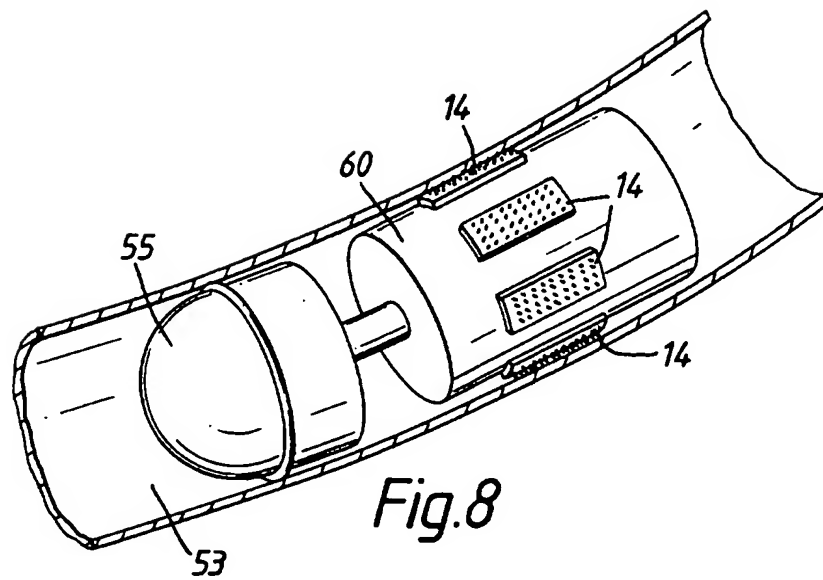


Fig. 7

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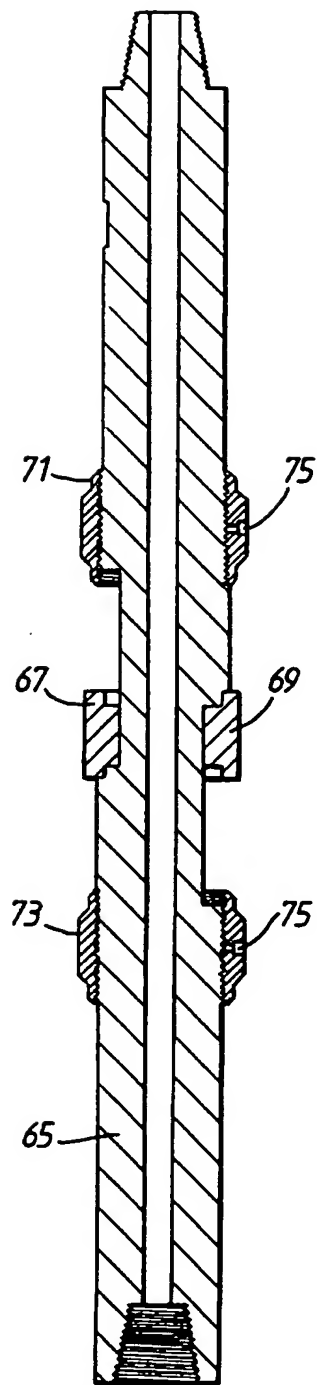


Fig.10

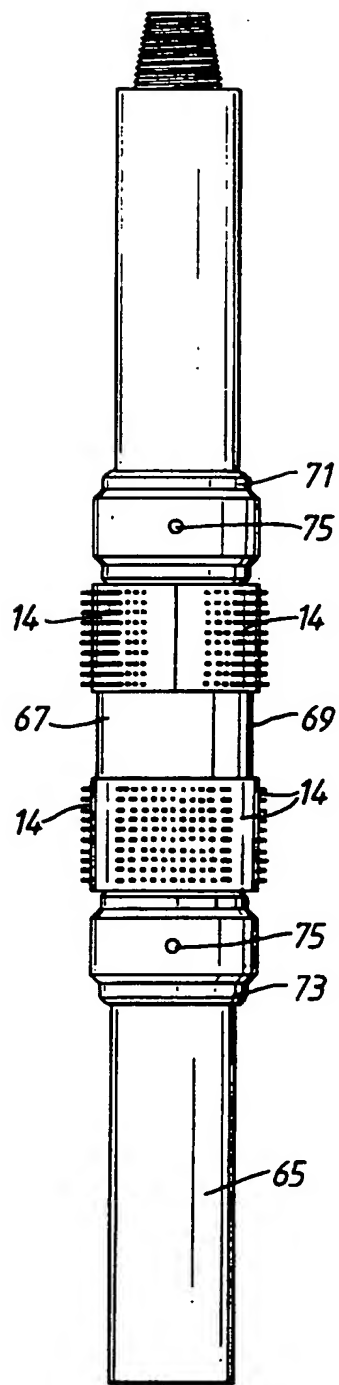


Fig.11

1 "Cleaning Apparatus"

2

3 This invention relates to apparatus for cleaning the
4 interior of a tubular member and especially, but not
5 exclusively, for cleaning the inside of pipelines or
6 oil, gas or water well tubulars, pipes or casings.

7

8 Due to the operating conditions and environment, oil,
9 gas and water well tubulars, pipes or casings require
10 regular cleaning. Conventionally, cleaning the inner
11 structure of a drill casing, pipe or tubing would
12 involve utilising a casing scraper assembly, such as
13 the Best (trade mark) oiltool casing scraper assembly.
14 Such a conventional assembly incorporates steel casing
15 scraper blades that scour the inside of the casing or
16 tubing. Typically, each blade features several raised
17 steel ribs that, once the scraper assembly has been
18 lowered down the tubing or casing required to be
19 cleaned, lie flush with the inner surface of said
20 tubing or casing.

21

22 Typically there are six scraper blades per scraper
23 assembly, three upper scraper blades positioned 60°
24 apart around the scraper assembly and three lower
25 scraper blades that are positioned 60° apart and 60°

1 offset, when compared with the upper three scraper
2 blades. Thus this conventional arrangement provides
3 for a 360° cleaning capability of the assembly.

4
5 A disadvantage of the conventional scraper blade is
6 that the raised steel rib arrangement is not efficient
7 since it requires considerable drill string movement to
8 clean the specified portion of the inner structure of
9 the tubing or casing, and it rapidly becomes less
10 effective with wear.

11
12 Another disadvantage of using conventional steel
13 scraper assemblies is that, if they become dislodged
14 from the scraper assembly apparatus, the cleaning
15 operation must be stopped, the scraper assembly
16 withdrawn and an attempt to retrieve the lost steel
17 scraper must be initiated, which may take a long time.

18
19 There are also safety implications if a conventional
20 steel scraper blade becomes dislodged from the scraper
21 assembly apparatus, on the basis that if the assembly
22 apparatus is not stopped quickly, then the steel
23 scraper blade will be free to impede the rotating
24 string.

25
26 The cleaning of pipelines may also present problems.

27
28 A first aspect of the present invention provides
29 apparatus for cleaning the interior of a tubular member
30 comprising a body member for insertion into the tubular
31 member, and at least one cleaning pad mounted on the
32 body member, the or each cleaning pad comprising a body
33 having an inner face engaged with the body member and
34 an outer face provided with protruding bristles.

35
36 Preferably, a plurality of cleaning pads are

1 circumferentially spaced around the body member.
2 Typically, there is an upper row of three cleaning pads
3 centred at 120° intervals, and a lower row of cleaning
4 pads centred at 120° intervals and circumferentially
5 offset with respect to the upper row.

6

7 The body member may comprise part of a pipeline pig or
8 be adapted to be coupled to a pipeline pig.

9 Alternatively, the body member may form a portion of a
10 length of drillstring.

11

12 The bristles may be of nylon. Alternatively, the
13 bristles may be of wire, such as flame hardened steel
14 or copper.

15

16 In a particularly preferred feature of the invention,
17 the cleaning pad is constructed to be drillable; that
18 is to be capable of being readily cut by a rock drill
19 bit.

20

21 The body may be manufactured from a compressible
22 material.

23

24 The inner portion of the body may be arranged so that
25 the body is compressible, the inner portion of the body
26 preferably being arranged in a honeycomb structure to
27 aid compressibility.

28

29 The body may suitably be of a resin fibre compound,
30 preferably a polyurethane fibre compound.

31

32 The bristles may be mounted in a backing secured to the
33 body, suitably by adhesive. The backing may be fabric
34 into which the bristles are sewn or woven, or may be an
35 elastomeric soft compound rubber material.

36

1 Alternatively, the body may typically be manufactured
2 from a malleable metal such as aluminium.

3

4 Typically, the brush pads may be interchanged to
5 different grades of bristle, to suit all types of
6 cleaning environment.

7

8 Preferably, the brush pads are held in place on the
9 body member by a sleeve, the sleeve being run along the
10 body member until it engages with the brush pad. More
11 preferably, the sleeve is threaded and most preferably,
12 the sleeve is provided with locking means for locking
13 the sleeve with respect to the body member.

14

15 The apparatus of the present invention may include a
16 protection device comprising at least one protection
17 pad, the or each protection pad being mounted on the
18 body member and being constructed from a softer
19 material than the tubular member.

20

21 Preferably, a plurality of protection pads are
22 circumferentially spaced around the body member.
23 Typically there is an upper row of protection pads and
24 a lower row of protection pads. Preferably the upper
25 row of protection pads is above the uppermost row of
26 cleaning pads and the lower row of protection pads is
27 below the lowermost row of cleaning pads.

28

29 The protection pads may be permanently secured to the
30 body member.

31

32 Alternatively the protection pads may be removable from
33 the body member.

34

35 The tubular member may be a pipeline or a tubular for
36 insertion into a borehole, such as well casing or

1 tubing.

2

3 Examples of cleaning apparatus in accordance with the
4 invention will now be described with reference to the
5 accompanying drawings, in which:-

6

7 Fig. 1 is an exploded perspective view of a first
8 example of well cleaning apparatus;

9 Fig. 2 is a perspective view showing the apparatus
10 of Fig. 1 in assembled condition;

11 Fig. 3 is a front perspective view of a cleaning
12 pad of the apparatus;

13 Fig. 4 is a rear perspective view of the cleaning
14 pad;

15 Fig. 5 is a perspective of a second example of
16 well cleaning apparatus;

17 Fig. 6 is a perspective view of a protection pad
18 for use with the apparatus shown in Fig. 5;

19 Fig. 7 is a sectional view of a cleaning pad of
20 the apparatus;

21 Fig. 8 is a perspective view of a first example
22 of pipeline cleaning apparatus;

23 Fig. 9 is a perspective view of a second example
24 of pipeline cleaning apparatus.

25 Fig. 10 is a sectional side view of a third
26 example of pipeline cleaning apparatus; and

27 Fig. 11 is a side view of the apparatus shown in
28 Fig. 10.

29

30 Referring to Figs. 1 and 2, a well cleaning apparatus
31 comprises a mandrel 10 for inclusion in a drill string
32 by means of a pin connector 12 and a box connector (not
33 seen in the drawings) at the lower end.

34

35 The mandrel 10 carries six cleaning pads generally
36 designated at 14. The cleaning pads 14 are arranged in

1 an upper row of three equally spaced around the
2 circumference of the apparatus and a lower row of three
3 equispaced pads offset from those of the upper row.
4 The mandrel 10 has projecting formations providing
5 upper and lower collars 16 and slots 19. Each cleaning
6 pad 14 (see also Figs. 3 and 4) is formed with an upper
7 lip 18, a lower lip 20, and angled side faces 22. Each
8 pad 14 is secured in position on the mandrel by
9 engaging one of the lips 18 and 20 underneath one of
10 the collars 16 with the side faces 22 engaged in the
11 slots 19. The inner ends of the pads 14 are then held
12 in position by a two part collar assembly 24 secured
13 together by screws 26. Each cleaning pad 14 is biased
14 outwardly by a series of coil springs 28 each engaging
15 in a corresponding bore 30 in the rear of the cleaning
16 pad 14.

17
18 Referring particularly to Figs. 3 and 4, each cleaning
19 pad 14 comprises a body 32 having an arcuate front face
20 34 and an arcuate rear face 36. Bristles 38 project
21 from the front face 34 to provide, in use, a scrubbing
22 action on the interior of the tubular being cleaned.
23 In a preferred form, the bristles 38 are formed from
24 flame hardened steel wire or copper wire and may
25 suitably be 1/8" diameter set at 1/8" spacings.

26
27 The body 32 is suitably a unitary moulding
28 encapsulating a portion of each of the bristles 38 and
29 is preferably moulded from a polyurethane fibre
30 compound.

31
32 In order to assist manufacture, the bristles 38 may be
33 set in a sheet of textile or rubber material before
34 being incorporated in the body 32.

35
36 The cleaning pads 14 may readily be interchanged to

1 provide a suitable cleaning effect from any particular
2 application. For example the pads 14 may be
3 interchanged for pads having smaller diameter wire
4 bristles or nylon bristles.

5
6 The cleaning pads 14 may be constructed from a
7 compressible material and further may have a honeycomb-
8 like centre 25, to aid compressibility, as can be seen
9 in Fig. 7.

10
11 In the event that one or more of the cleaning pads 14
12 becomes dislodged from the mandrel 10, the nature of
13 its construction is such that it is readily drilled
14 through by a drill bit or other implement commonly used
15 in a well tubular, since the polyurethane body is
16 relatively easily drilled away leaving relatively small
17 pieces of wire which can be handled in a manner similar
18 to drill chippings.

19
20 The well tubing may change direction by a relatively
21 high degree, thus requiring the drillstring to navigate
22 this change in direction if, for instance, the
23 drillstring is being run in or pulled out of the well
24 tubing.

25
26 Fig. 5 shows a second example of well cleaning
27 apparatus with protection pads 50 mounted on the
28 mandrel 10 and arranged in an upper row and a lower
29 row. The upper row of protection pads 50 are located
30 above the upper row of cleaning pads 14, and the lower
31 row of protection pads 50 are located below the lower
32 row of cleaning pads 14. The protection pads 50
33 project outward from the mandrel 10 by a sufficient
34 length so that if the mandrel 10 navigates a change in
35 direction of the well tubing, the protection pads 50
36 are substantially the point of contact between the

1 mandrel 10 and the well tubing. As the protection pads
2 50 are constructed from a softer material than the well
3 tubing, the protection pads 50 are sacrificed in order
4 to protect both the mandrel 10, the cleaning pads 14
5 and the well tubing. An individual protection pad 50
6 is shown in Fig. 6.

7
8 Fig. 8 shows a first example of pipeline cleaning
9 apparatus, wherein a pig 55, 60 is run into a pipeline
10 53 that requires to be cleaned. Conventionally, the
11 pig 55, 60 has a first module 55, and a second module
12 60 and is run into the pipeline 53 by means of a fluid
13 pressure that is built up behind the second module 60.
14 Cleaning pads 14 can be mounted around the
15 circumference of either the first module 55 or the
16 second module 60. In Fig. 8 the cleaning pads 14 are
17 mounted around the circumference of the second module
18 60. The cleaning pads 14 can be biased outwardly by a
19 series of coil springs (not shown) as in the embodiment
20 shown in Fig. 1.

21
22 Fig. 9 shows a second example of pipeline cleaning
23 apparatus, wherein the cleaning pads 14 are mounted on
24 a suitable body 62, which is connected to the second
25 module 60 of the pig. Thus, the body 62 follows the
26 pig down the pipeline 53 requiring to be cleaned.

27
28 Fig. 10 and Fig. 11 show a third example of pipeline
29 cleaning apparatus, wherein the cleaning pads 14 are
30 mounted on a body 65. One end of the cleaning pad 14
31 is held in place on the body 65 by two half shells 67,
32 69, which are welded together around the body 65. The
33 other end of the cleaning pad 14 is held in place by a
34 stabilizer sleeve 71, 73, each of which is threaded
35 onto the body. When the stabilizer sleeves 71, 73 have
36 been threaded onto the body 65 to the desired position,

1 the stabilizer sleeves 71, 73 are locked in position by
2 a locking nut 75 which engages a recess in the body 65,
3 and hence the stabilizer sleeves 71, 73 are locked with
4 respect to the body 65.

5

6 Modifications may be made to the foregoing within the
7 scope of the present invention.

1 Claims

2

3 1. Apparatus for cleaning the interior of a well
4 tubing, comprising a body member for insertion into the
5 tubing, and at least one cleaning pad mounted on the
6 body member, the or each cleaning pad comprising a body
7 having an inner face engaged with the body member and
8 an outer face provided with protruding bristles.

9

10 2. Apparatus according to Claim 1, wherein a
11 plurality of cleaning pads are circumferentially spaced
12 around the body member.

13

14 3. Apparatus according to Claim 2, wherein there is
15 an upper row of three cleaning pads centred at 120°
16 intervals, and a lower row of cleaning pads centred at
17 120° intervals and circumferentially offset with
18 respect to the upper row.

19

20 4. Apparatus according to any of the preceding
21 claims, wherein the bristles are nylon bristles.

22

23 5. Apparatus according to any of Claims 1, 2 or 3,
24 wherein the bristles are hardened metal wire bristles.

25

26 6. Apparatus according to any of the preceding
27 Claims, wherein the cleaning pad body is constructed
28 from a drillable material.

29

30 7. Apparatus according to Claim 6, wherein the
31 cleaning pad body is constructed from a resin fibre
32 compound.

33

34 8. Apparatus according to Claim 6, wherein the
35 cleaning pad body is manufactured from a malleable
36 metal.

1 9. Apparatus according to any of the preceding
2 Claims, wherein the cleaning pad body is compressible.

3

4 10. Apparatus according to any of the preceding
5 Claims, further comprising at least one protection pad
6 mounted on the body member, the protection pad being
7 manufactured from a softer material than the well
8 tubing material.

9

10 11. Apparatus according to Claim 10, wherein a
11 plurality of protection pads are circumferentially
12 spaced around the body member.

13

14 12. Apparatus according to Claim 11, wherein there is
15 an upper row of protection pads and a lower row of
16 protection pads, where the upper row of protection pads
17 are located above the upper row of cleaning pads and
18 the lower row of protection pads are located below the
19 lower row of cleaning pads.

20

21 13. Apparatus according to any of the preceding
22 Claims, wherein a first end of the cleaning pad is
23 mounted on the body member by a fixed collar, and a
24 second end of the cleaning pad is mounted on the body
25 member by a moveable sleeve.

26

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